Saskia M. Peerdeman
W. Peter Vandertop

**Reply to Comment on
"Changes in cerebral interstitial
glycerol concentration in head
injured patients; correlation
with secondary events",
Intensive Care Med (2003)
29:1825–1828**

Received: 19 October 2003
Accepted: 12 November 2003
Published online: 13 January 2004
© Springer-Verlag 2004

We greatly appreciate Dr. Nordstrom's comments on our paper on the correlation of glycerol and secondary events in severe brain-injured patients [1].

First, he states that a cerebral perfusion pressure (CPP) of less than 70 mmHg over 30 min cannot be regarded as an adverse event. When we started the study, we followed the guidelines for the management of severe head-injured patients, which was published in 2000 [2] and which recommended a CPP of >70 mmHg. Only recently, an update of this guideline has become available stating that the CPP should be maintained at a minimum of 60 mm Hg, indicating that the level of 70 mm Hg is indeed not a strict one [3]. Since we do not use so-called "Lund therapy" as a treatment for raised intracranial pressure (ICP), the data of the papers mentioned by Dr. Nordstrom cannot automatically be applied to our patient population. However, because of his comment, we have reviewed our data based on a CPP limit of 60 mmHg. A total of 58 episodes occurred and, again, no correlation could be found!

Dr. Nordstrom's second remark concerns the correlation of the absolute interstitial glycerol concentration with the outcome. We agree with him that the interstitial concentration of glycerol in an area of brain contusion or a penumbra zone is higher than that in normal brain tissue. The correlation between the level of glycerol and outcome will therefore be different when different target areas are studied. The only data available on interstitial glycerol concentration in normal brain tissue under physiological circumstances have been published by Reinstrup et al. from Dr. Nordstrom's group [4].

Fig. 1 Interstitial values of lactate, pyruvate, glucose and glutamate compared with glycerol values (in $\mu\text{mol/l}$) in a 67-year-old patient, dying on day 2 after severe head injury

Although it is statistically correct to state that, if the mean glycerol level is $82 \pm 44 \mu\text{mol/l}$, 2.5% will be above 170 $\mu\text{mol/l}$, it is important to realise that these figures were calculated on the basis of only five patients. One could question the statistical relevance of this statement without knowing the median and the range. Furthermore, these were values in awake patients. All our brain-injured patients were sedated and some were paralysed as part of their treatment. It might be more appropriate to use the values during anaesthesia as a reference. Although the microdialysis technique used during anaesthesia was different than that in our patient group, the reference value for sedated patients would still be lower than 150 $\mu\text{mol/l}$. Of course, it is true that the microdialysis technique only gives information concerning a small area surrounding the probe. However, we believe that, based on our data, a high level of interstitial glycerol in brain tissue appearing normal on computerised tomography scan indicates more severe damage than would be expected.

Other biochemical variables of our illustrated case are presented in Fig. 1. An early warning (<6 h before ICP increase) as an explanation for the glycerol increase is unlikely. It is possible that no further cell membrane degradation took place and that therefore a gradual decrease in glycerol occurred. This supports our theory that a high level of glycerol in normal-appearing brain tissue reflects the damage inflicted by the accident.

References

1. Peerdeman SM, Girbes AR, Polderman KH, Vandertop WP (2003) Changes in cerebral interstitial glycerol concentration in head-injured patients; correlation with secondary events. *Intensive Care Med* DOI:10.1007/s00134-003-1850-8
2. Brain Trauma Foundation, American Association of Neurological Surgeons, Joint Section on Neurotrauma and Critical Care (2000) Guidelines for cerebral perfusion pressure. *J Neurotrauma* 507–511
3. Brain Trauma Foundation, American Association of Neurological Surgeons, Congress of Neurological Surgeons, Joint Section on Neurotrauma and Critical Care (2003) Update notice. Guidelines for the management of severe traumatic brain injury: cerebral perfusion pressure. http://www2.braintrauma.org/guidelines/btf_guidelines_cpp_u1.pdf
4. Reinstrup P, Stahl N, Møllergaard P, Uski T, Ungerstedt U, Nordstrom CH (2000) Intracerebral microdialysis in clinical practice: baseline values for chemical markers during wakefulness, anaesthesia, and neurosurgery. *Neurosurgery* 701–709

S. M. Peerdeman (✉) · W. P. Vandertop
Department of Neurosurgery,
VU University Medical Center,
Amsterdam, The Netherlands
e-mail: sm.peerdeman@vumc.nl